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NOTES ON THE MANUFACTURE OF POTTERY AMONG SAVAGE RACES.¹

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MISSION OF BRAZIL.

IN making a critical study of the Indian pottery of Brazil, both ancient and modern, I have been led to investigate some facts in connection with the methods employed in primitive ceramic art, which, up to the present time, have received but little attention.

Some of the more important of the conclusions reached by a study of ceramic ornament have been already briefly sketched in a paper on "Evolution in Ornament" (*Pop. Sc. Monthly*, January, 1875), in which I have attempted to show the origin and function of Decorative Art, and describe some of the more important steps in the growth of these ornamental borders so common on pottery, and known as frets, scrolls and honey-suckle patterns.

The use of pottery is unknown to many savage peoples, as for instance to the Esquimaux, the northern Indians of North America, the Botocudos and Cayapós of Brazil,² the Pampean races, the Fuegians, the Veddahs of Ceylon, the Andaman Islanders, the Australians, the Maoris and the Polynesian islanders generally. In some cases this ignorance of the art may be accounted for by the exceedingly low degree of culture of the tribe, as among the Botocudos. In Greenland we should scarcely expect the manufacture of earthenware to flourish, and its absence among the Greenlanders is compatible with a considerable advance in other arts.

Among the Algonkin tribes of Canada and the North-eastern United States, cooking is often done in vessels of bark, either by placing the vessel over the fire or by putting hot stones in the liquid (*Relation de la Nouv. France*, 1633, p. 4).

I have seen the Micmac Indians of Nova Scotia make square

¹ The following article, published at the office of the *South American Mail*, in Rio Janeiro, in 1875, assumes an intensified interest from the sad death of its author, even before his scientific career can be said to have fully begun. A few introductory and non-relevant sentences, and long quotations are necessarily omitted.—O. T. M.

² Among the Indians included in the great family of the Cayapós by Dr. Couto de Magalhães, may be mentioned the Gradahús, the Gurutirés of the Xingú, the Caca-hós of the sertões of Maranhão, and the Cayapós of Matto Grosso.

or oblong vessels of the extremely thin, paper-like bark of the birch (*Betula papyracea* Ait.) and cook in them directly over the fire, just as water may be boiled in a paper cup. The Kutchin tribes of the MacKenzie river have no pottery, but they make kettles of tamarack roots, woven together very tightly and neatly, and ornamented with dyed porcupine quills, in which vessels they boil water with hot stones (Jones Smith's Report, pp. 66, 321).

The Indians of Santa Catalina, in California "brought fresh water to the Spaniards in flaskets made of rushes" (Burney, 2d Voy. of Sebastian Vizcaino, So. Sea Described, p. 248). Similar vessels are still in use in the same region, and Major Powell brought home from the Colorado, water baskets lined inside with pitch. The Maués of the Amazonas use water-tight baskets, and so also do the Kaffirs. Wooden kettles for stone boiling are found among many tribes, both in America and elsewhere, and the inhabitants of Amboyna and Ternate cook in bamboos (Chardin, iv, pp. 171, 172; *Receuil des voyages*, &c., iii, 322.)

The possession of a material like birch bark may render pottery to a certain extent unnecessary, and thus retard its invention and adoption. The whole subject of cooking in wooden vessels and of stone boiling has been admirably discussed by Tylor. That the inhabitants of the coral islands of the Pacific should be without pottery is not wonderful. It is said, also, that there is no potters' clay in the Sandwich Islands.

Man is not the only animal that makes vessels of clay, but he is the only one that bakes them in the fire to make them durable. Other animals make nests of clay for their young, but primitive man makes earthenware vessels in which to hide away his dead. Man's most primitive vessel was his hand; but leaves, shells, bark, tough skins or shells of fruits, sections of bamboos, &c., were soon used, as by means of these he could not only dip up water, but also transport it from place to place. The same vessels must also have served for the preservation and transportation of articles of food, etc. The art of pottery has, doubtless, originated independently in many different nations, and many circumstances may have led to the employment of clay for the manufacture of vessels. At Unalashka, Capt. Cook (Voy. ii, 510) saw "vessels of a flat stone, with sides of clay not unlike a standing pye." Lyons says (Private Journal, p. 320) that the Esquimaux women have an ingenious method of making lamps and cooking-pots of

flat slabs of stone which they cement together with a composition of seal's blood applied warm, the vessel being held at the same time over the flame of a lamp, which dries the plaster to the hardness of stone, and in a note he adds, that "the cement is composed of seal's blood, of whitish clay and of dog's hair. The natives think that the hair of a female dog would spoil the composition and prevent its sticking." On the Lower Murray the natives line a hole in the ground with clay, and cook their food in it, and sometimes they coat wooden vessels and gourds with clay to prevent their being burned. Both these customs just described might lead to the invention of pottery.

The material of which pottery is made is clay. Ordinary clay consists of fine particles of more or less decomposed feldspar, mixed with a larger or smaller percentage of free silica, which last may exist, either as an impalpable powder, or as a more or less coarse sand.

Kaolinite, used in the manufacture of porcelain, is a silicate of alumina derived from the decomposition of feldspar, containing soda or potash, and it consists mainly of a mixture of silicate of alumina and free silica.

Pure clay will not make pottery, because of its tendency to shrink and crack in drying and baking. It must, therefore, be mixed with some substance to counteract this tendency. In the making of sundried bricks, the Egyptians found it necessary to mix the clay with straw.

In pottery, the substance added is called by the French a *dégraissant*. One of the best materials for this purpose is sand, or powdered silica in some form, especially if the ware is to be burned at a high temperature.

The Danish archæologists have shown that the clay of which the pottery of the Kjœkkenmœddings was made, was mixed with powdered granite, apparently obtained by heating the rock and plunging it into water. In Chiloë to-day, the natives obtain a *dégraissant* for pottery in the same way (Wagner *Chimie Industrielle*. Tom i, 555). In some kinds of earthenware manufactured in England and on the Continent, powdered flint is added to the clay, the flints being prepared by heating them red hot, then throwing them into water, and afterwards pulverizing them (Brogniart, *Arts Cer.* 1854, i, 71).

Sometimes a cement of pulverized pot-shreds or *terra-cotta* is

added in the manufacture of certain kinds, both among civilized and savage nations. In making, for metallurgical purposes, crucibles that are required to stand great heat and sudden changes of temperature, burnt clay, obtained by powdering old crucibles, is sometimes added to the raw clay to prevent cracking (Fonck. *Zeitschr. f. Eth.* ii. 1870, iv, 290, Ure's Dict. sub Pottery; Brogniart i, 72).

The ancient Indians of Pacoval, on the island of Marajo, used to mingle powdered pottery with the clay for their ware, and in the mass composing the walls of fractured specimens from Sr. Ferreira Penna, I have found quite large fragments still showing their painted surfaces.

In both North and South America, where the Indian pottery is rarely ever thoroughly burned, the clay is often mixed with broken shells. Mica enters frequently into the composition of pottery, and Dr. Berendt has informed me that in Yucatan, even wash gold was occasionally used. Gold is also found in the material composing the pottery of Palembang, in the East Indies (Jour. E. Ind. Archipelago, 1850, iv, 273).

Powdered coke or furnace cinders, graphite, amianthus (Brogniart, l. c. i, 74), and even sawdust are employed in some kinds of modern European pottery, and where a low heat is used in baking, the clay is sometimes mixed with powdered limestone. At a higher heat this latter would serve as a flux.

I am not aware that the Indians of North America ever mixed ashes with the clay, but the custom is very general in South America, where the ashes of the bark of several trees are employed. In Guiana the bark used is that of the Couepi tree, (*Couepia guianensis*) (Ferdinand Fermin, Description générale, &c., de Surinam, i, 61).

On the Amazons the clay intended for the manufacture of pottery is mixed with the ash of the *Caraiapé* tree, (*Moquilea utilis* Hooker) (Benth. Martius, Flora Braziliensis, Fasc. xli, Pl. 8, f. 11; Wallace, Travels on the Amazon, &c., 484; Marryatt, "Pottery and Porcelain," 509; Bates, "Naturalist, &c." 225). The Carajás, Caraja-is, Chambiósas, Chavaútes, Chereútes, and Guajajaras of the Araguaya, mix with the clay the ashes of certain *sipós*. I have seen the *Caraiapé* bark prepared by stacking the fragments on end in a conical heap, and then burning them in the open air. The ash is very abundant and preserves the original form of the frag-

ments. Having been reduced to powder and sifted, it is thoroughly intermingled with clay, to which, when wet, it gives a dark plumbaginous look, but this color grows much lighter on burning. The use of the *Caraipé*, according to universal testimony, makes the ware better able to stand the fire. The Indians of Sariacu use the ash of a bark called *Apacarama*, perhaps the same as *Caraipé* (Smythe & Lowe, Nar. of a Journ. from Lima to Para. Lond., 1836, 210). The *Caraipé* bark contains an enormous percentage of silica, which separates as a fine white powder. It is to this siliceous powder that the ash, doubtless, owes its value as a *dégraissant*. In the Amazonian region is found a species of fresh-water sponge, called *Cauxi*, containing siliceous spicules, and whose ash is sometimes used to temper clay for pottery (De Souza, Lembranças, etc. do Amazonas, 101). According to Semper (Der Stil. Band ii, 122) the use of these *dégraissants* and cements, besides destroying the homogeneity of the paste, furnish innumerable points of rest throughout the mass that reduce the fragility of the ware after burning, and the danger of cracking, whether through change of temperature or by shock. The coarser particles serve to break up and distribute the undulations by which the cracks are propagated, very much as a fracture in a pane of glass may be arrested by boring a hole at the extremity of the crack.

By the advent of Europeans, pottery in America was invariably made by hand, the potters wheel being unknown. In the province of Para, among the Indians, and to a considerable extent among the whites, as each family makes its own pottery, stores of this clay are often laid up.

The clay, mixed with *Cariapé*, is kneaded with the hands into a mass, which is then divided into a number of balls about as large as the first. The woman potter then furnishes herself with a board or mat, on which to build up the vessel, some flat object on which to roll out the clay, a vessel of water, and a fragment of a *cuia* or a shell to serve as a smoothing instrument. If the vessel is to have a flat bottom, she presses out upon the board a round flat piece of the required size and thickness. This takes the impress of the board or mat, and fragments of the bottoms of vessels from the ancient site of the "Bluff-Dwellers" at Taparinha, near Santarem, are often beautifully impressed by the mat on which they were formed. Indian women of Santarem sometimes seat

themselves on the ground holding a large ball of clay between the feet. On this the vessel is built up, the ball being afterwards cut off, leaving the bottom flat.

After the bottom is formed, a piece of clay is rolled under the hand into a long rope-like cylinder. This rope is then coiled round the edge of the bottom of the vessel, being flattened sideways by pinching with the fingers of the left hand, and caused to adhere to the bottom. On this, coil after coil is laid in like manner, each being flattened as before.

After a few have been added they are worked into shape with the fingers, which are occasionally moistened in water, and the irregularities produced by the coils are caused to disappear. The vessel is formed by the hand alone, and the surface is smoothed down by means of a bit of gourd or a shell, which is, from time to time, dipped in water. If the vessel be large, it is now set away in the shade for a while to dry a little, after which new coils are added as above, no other instrument being used except the hands and the gourd or shell, with which alone the vessel may receive not only an extremely regular form but also a very smooth surface. According to Dr. de Magalhaes, "the pottery of the Carajás, the Carajáis, Chambioás, Chavântes, Cherêntes, Guajajaras of the Araguáya river is always made by coiling, the surface being worked down by the hand and water, and the aid of a sort of spoon-like trowel made of bamboo." The coils are so worked together that from a simple inspection of the vessel it is impossible to determine how it was built up. I should never have suspected that the pottery of Pacoval had been made by coiling, were it not that I found the coils still ununited on the inner surface of the heads of idols. The coils still preserve the delicate imprints of the fingers of the artist (*AM. NATURALIST*, v. 1871).

In building up a vessel, care must be taken to allow it to harden as the process progresses, so as to avoid its settling by its own weight, as it is very likely to do, especially if the vessel be large. This settling, under the influence of gravity, is, however, likely to give rise to graceful curves, and it would be interesting to determine how far the beauty of outline of pottery may have resulted from the imitation of forms that originated in this way.

Handles and all prominent ornaments are added afterwards, being luted on. Sometimes the outside of the vessel is orna-

mented by applying thin strips of clay laid on in spirals, and other figures as among the Greeks and Romans.

The ancient Bluff-Dwellers were very fond of ornamenting their pottery in this way. The "apple-pie" border, made by impressing with the extremity of the finger, or by pinching up a line of elevations between the thumb and forefinger, was also in common use among the same Indians, and is still perpetuated on the modern pottery of the Amazonas. It was rarely used by the Indians of Pacoval.

In Amazonian pottery, ornaments are rarely impressed or stamped. I have observed on the Bluff-Dwellers' pottery, circles made with the end of a hollow stick. The Chambioás and Carajás of the Araguáya make wooden dies, with which to ornament their pottery, the Carajás using a sort of Maltese cross.

The surface of the vessel, after having been smoothed down, is often washed with a thin layer of pure, creamy clay, which appears to be sometimes burnished before cooking, producing a beautiful, hard and almost polished surface. The common ware of the civilized Indians of the province of Para is usually very plain and rarely ever painted, but that of the Upper Amazon is often most beautifully ornamented in several colors, with frets and borders, and other purely æsthetic forms, the absence of all attempt at representations of plant forms being remarkable. Edwards says that the colors are laid on this Amazon pottery with a brush made of the spine of a palm. The black color is made of the juice of *mandioca*.

The ancient pottery of Pacoval is often adorned with frets and scroll borders and other ornaments, drawn on a white ground with marvelous accuracy (AM. NATURALIST, V., 1871; *Pop. Sc. Monthly*, Jan., 1875).

Ornaments are sometimes scratched with a sharp point on the surface of modern Amazonian pottery, and, occasionally, ornaments are made consisting of a series of holes. The etching on the Pacoval pottery is exceedingly delicate. Sometimes the same pottery is decorated by first washing the surface with white clay, and then engraving so as to leave an ornament in relief. The instrument used seems to have been a tooth of a *paca*, or some other rodent. Some of the large burial vases are covered with ornaments of this kind, which must have required long and patient labor.

Before burning, the vessels are allowed to dry slowly in the shade, and afterwards in the sun. The burning requires much care, and is performed in different ways. Usually, they are set at a distance from the fire, and allowed to become heated gradually, without actual contact with the flame, after which they are surrounded by fire and thoroughly burned. Very often they are covered with a heap of *Caraipe* bark, which is set on fire. Sometimes, on the Amazonas, pottery is burned in an oven or in a hole in the ground. The Carajás and other tribes of the Araguaya burn their pottery in ovens made by hollowing out the nests of the white ant. The ware is introduced, another excavation is made below the fire, and still another in the top of the nest to serve as a chimney. The enormous earthen pans (*yapona*) on which farina is cooked, and which are sometimes four or five feet across, require to be burned with great care, and their manufacture is usually entrusted only to women of much experience. Ordinarily the pottery of the Amazonas is not thoroughly cooked. That of the Bluff-Dwellers is particularly poor in this respect. While the vessel is still hot after burning, it often receives inside a coating of melted *jutahy-sica* resin, applied with a swab, but I am informed that before the vessel is used on the fire, this is first burned out. This resin is said to be obtained from the *Jutahy* tree of the Amazonas (*Hymenæa courbaril*); but it does not appear to be the product of the *Jutahy* alone.

At Brêves, on the Island of Marajó, there is made a kind of pottery which is first washed with white clay, and after burning, painted in water color in the most gaudy and outrageous fashion. Over this color a varnish of *jutahy-sica*, dissolved in alcohol, is laid. A similar resin, said to be the product of the same species of *Hymenæa*, is used to varnish painted ware among the Maypures on the Orinoco (Humboldt, Pers. Nar. ii, 309). The Abiponian women rubbed their pottery with a kind of glue to make it shine (Dobritzhoffer, Hist. of Abipones, ii, 131). The Indians of Guiana paint their pottery with water color, and varnish it with the gum *simiri* (*Simiri tinctoria*) or *bourgoni* (*Robinia bourgoui*). In Yucatan, Behrendt reports the use of a varnish made from the *Nin* (*Coccus axin* Lallave). The Fijians glaze their ware with a resin, and the ancient Egyptians sometimes painted pottery in distemper and covered it with a resinous varnish ("Pottery, in

Chambers' Encyc. ; Williams and Calvert, Fiji, &c., 53; Jenkins' U. S. Expl. Ex., 347 ; Birch, *Anct. Pottery*, i, 48, 49 ; Brogniart, *ut supra*, i, 502). Von Martius alludes in general terms to the mode of building up an earthen vessel by coiling (*Ethno. Amerikas*, 712); and the same method appears to have been alluded to by Humboldt (*Pers. Nar.*, ii, 309) when he says that the natives of the Maypures on the Orinoco "purify the clay by repeated washings, form it into cylinders, and mould the largest vessels with the hand."

We meet with the same method again in Chilöe, where it has been described by Dr. Fonck (*Die Indier des Südlichen Chile*, &c.), who speaks of the vessel as being built up exactly as at Ereré, a flat piece being first made for the bottom, on the periphery of which the wall is formed by coiling up a sausage-like cylinder. He adds that the ware is dried in the smoke before burning (*Zeitsch. für Eth.*, 1870, iv., 290).

Gili describes the process of coiling as found among the Indians of Orinoco, and adds that the surface of the vessel is worked down with a pebble and the fingers, which are, from time to time, dipped into water, the ware being burned in pits with a fire made of bark.

Prof. Charles Rau, the first ethnologist to give due importance to the method of coiling, has, in his admirable essay on Indian Pottery (*Smithson. Rep.*, 1866, 351), translated the description given by Dumont of the manufactory of earthenware by the Indians of Louisiana, in which an account of the building up of a vessel by this method is given (*Mem. Historiques sur la Louisiane*). Prof. Rau is of the opinion that the building up of pottery by coiling was practiced over a large area in North America. Certainly in South America it was widely known.

Prof. Eggleston, of Columbia College, New York, informs me that in Germany, the large crucibles used in melting are, when broken, built up again with ropes of clay. In this case we have either a survival of an old pre-historic art, or its re-discovery in modern times.

I will now give such information as I have been able to gather concerning the manufactory of pottery by the aboriginal inhabitants of America, for the double purpose of giving a clearer idea of the various processes used, and also of showing that the manufacture is everywhere exclusively in the hands of women.

Molina says (Saggio, &c., Bologna, 1872), that the Chilians have excellent pottery, which they burn in furnaces, or rather holes dug in the sides of the hills, and adds that they apply to their wares a sort of varnish made of a certain mineral earth. Schmidtmeier (Trav. into Chile, Lond. 1824, 117) says that the present Chileños are good potters for common ware: they introduce a certain quantity of earth or sand, containing an abundance of yellow mica; and jars, holding seventy gallons or more, are made by them of great thinness, lightness and strength, and which sounds as if it were metal. The Pehuenches of Chili, a wandering tribe, made new vessels in every locality in which they establish themselves (Pöppig, Reise in Chile, &c., Leipz., 1835, i, 383).

In Bolivia, the women fabricate the pottery with much superstitious ceremony (D'Orbigny, L'Homme Amer., ii, 150, 233, 339, 363). According to Castelnau, the Chiriguano women are excellent potters. One vessel measured by him was a metre in diameter and twelve decimetres in height (Exped. vi, 56, 307). Woman's work among the Mojos Indians comprises also the manufacture of earthenware (D'Orbigny, ut supra 233). Gibbon speaks of one Juana Jua Cayuba, a Mojos woman, who superintended the hired women who were engaged in moulding earthen jars (Expl. of the Valley of the Amazonas, p. 246).

The Guarayos women also made pottery, and D'Orbigny speaks of the large vessels in which the dead of the tribe are buried (Frag. d'Une Voy. au Centre de l'Am. Meridionale, 193).

Both the ancient and modern inhabitants of the Andes were famous potters, and the vases of the *Huacas* of Bolivia and Peru have long attracted the attention of ethnologists (von Tschudi y Rivero, Antiq. de Peru; Cat. du Musée de Sevres; D'Orbigny, Atlas d'Antiq. Peruv.; Brogniart, Arts Ceram., i, 525; Ewbank, Life in Brazil). The majority of Peruvian vessels were undoubtedly formed in two or more pieces, in a mould, and afterwards luted together. Some of these molds were made from natural objects, but others bear very elaborate raised figures.

The women of the Indians of Ucayali are represented as being the potters. The Tobas of Mbocobi of the Chaco, manufacture immense *chica* pots like those of the Chiriguano, the work falling to the lot of the women, as was the case also among the Indians of Itaty, a village of Guaranis, situated at the confluence

of the Paraná and Paraguay (D'Orbigny *L'Homme Am.*, ii, 100; *Voyage, &c.*, i, 199; Brogniart i, 530).

Dobritzhoffer says, "The American women seem to have a natural talent for making various articles. They can mold pots and jugs of various forms of clay, not with the assistance of a turning machine like potters, but with their hands alone. These clay vessels they bake, not in an oven but out of doors, placing sticks around them.

The pottery of the Payaguás, of Paraguay, was the work of women. Among the Guaycurús, pottery appears to have been woman's work, for Prado tells us that, in this tribe were found men who affect all the manners of women, not only dressing like them but occupying themselves in spinning, weaving, making pots, etc. (*Hist.*, in *Revista Trimensal do Inst. Hist.* i, 32).

Hans Staden, who was a captive among the Tupinambás, relates that the women of that tribe were the potters. The vessels after having been dried in the air and painted with lines of different colors, were turned upside down on stones, and burned by heaping bark about them and setting it on fire (DeBry, *Americae*, 3d Part, ii, xiv, 3; See also DeBry, *Hist. Nav. in Braziliam*, p. 133, 141, 142, 239).

The women of the Arraial do Barro, opposite the Island of Sao Sebastiao are said to have made excellent ware (*Art. de Verifier les Dates*, 13, p. 110).

The women of the Mongoyós prepared the clay on a banana leaf held upon the knee. It was then placed upon a "plateau" of sifted ashes, and the vessel, after fashioning and polishing, was submitted to the action of fire.

A writer on Brazil (*Noticia do Brazil*, Lisboa, 1825, iii, 1, 286), says, that the old Tupinambá women made pottery by hand, some of which were big enough to hold a pipe. They also made pots, mugs and pans. This pottery, which was sometimes painted, was burned in a pit, a wood fire being made above. They superstitiously believed that if any one but the person who moulded the pottery were to attempt to burn it, the vessel would break to pieces in the fire.

Spix and Martius (*Travels*, Lond. 1824, ii, 246) tell us that the Coroádo women provide the requisite earthenware for the family. Pottery is still made by the civilized Indian women in many parts of Brazil south of the Amazonas. Old women make earthenware

by hand in S. Paulo. The clay is mixed by being trodden under the feet of oxen, the vessels being formed by coiling or by molding in several pieces. The clay is sometimes worked into a thin sheet, which is applied to the surface of a wooden mold. The outside is worked down with the wetted hand and the application of a corn cob. After the vessel has dried to the proper consistency, it is cut in two, the mold is removed, and the two pieces are skilfully luted together. Pottery is made in the same way in Bahia.

Except in the olarias, where earthen vessels are made on a large scale, men nowhere in the Amazon region have anything to do with this industry. (On the manufacture of pottery by women in various parts of S. America, see Baena, *Ensaio Corographico do Pará*, sub voce "Monte Alegre;" Candido Mendez de Almeida, *Pinsonia*, 1873, 28; Herndon, *Explor.*, 202; Wallace, *Travels*, 172; Debret, *Voyage Pittoresque*, Paris, 1834, *Catalogue du Musée Ceramique de Sévres*; Brogniart, *Arts Ceramiques*, i, 532; Humboldt, *Personal Narrative*, i, 196; Gili, *Storia Americana*, ii, 315; Gumilla, *Histoire Naturelle*, &c., de l'Orénoque, i, 268; Schomburgk, *Hakluyt Soc.*, *Discov. of Guiana by Sir W. Raleigh*, 64, note; *id.* *Journ. Eth. Soc.*, Lond., 1848, i, 267; *Art de Vérifier les Dates* T. 15, 285; Perez, *Jeographia de los Estados Unidos de Columbia*, i, 485; *Bull. Soc. d'Anth.* Paris, T.i, Serie i, 1866, 403; Squier, *Rare and Original Documents and Relations*, p. 46; *Bibliotheca de Autores Españoles*, *Historiadores primitivos de los Indias*, i, 348).

Dr. Berendt writes from Yucatan that "certain classes of pottery, manufactured in some towns of the interior, are not only carried all over the country, but exported to other parts of Mexico, and even to Havana; among them are unglazed basins for cooling drinking water, also large and small water-jars, some preserving the ancient Yucatan forms, others imitating foreign models. These are made by men, mestizoes, and mostly by hand, on the turning wheel. In some places far away in the interior, or without any connection with the larger centers of trade, as also in Peten, the proceeding is still more primitive, and is exclusively in the hands of women. They search for the clay, load it on the backs of children, and work it on the *metate* before fashioning it with the hands. Large jars they generally form from two pieces. I have not seen that they mix their clay with ashes;

but they often mix different kinds of clay together. The class of pottery used by the poorer classes comprises the *comal*, (flat plates to bake tortillas on), *cajetes*, or small plates (saucers) for certain dishes, etc. No kind of glazing is used for this kind of pottery, but in its place a varnish is sometimes used, made from *Niin* (*Coccus Axin* Lallave), and this is occasionally painted. It is an ancient proceeding. I possess a vase, dug out at Jaina on the Gulf Coast north of Campeche, whose varnished and painted outer surface imitates admirably the design of ash wood. The pottery of the ancient Mayas shows great variety in form and in structure. Clay of different colors (dark red, light slate color, light and dark red, and brown) is sometimes mixed with mica or shell-gravel, and other substances, such as, in other parts, even wash gold. The ornamentation consists of figures and arabesques sunk or scratched into the surfaces, or elevated into reliefs and often painted. The modern pottery of the Indians is generally plain. The ancient pottery found in the interior, and particularly near the gulf-coast of Yucatan, shows a much higher art than that from the east coast, Cozumel island, etc."

Pottery making fell to the lot of the Carib women, and according to Ligon they manufactured a very handsome light ware (De la Borde, "Relations de l'origine, &c., des Caraibes, &c., Recueil de divers Voyages, p. 23; McCulloh, Researches concerning the Aboriginal History of America, p. 84).

Mr. Squier describes the pottery of Nicaragua as painted and glazed (Nicaragua, i, 287). The ceramic artists among the Indians of Fort Yuma, California, are women, and the same is the case with the Zuñis, whose beautifully painted pottery closely resembles that of the ancient Indians of Pacoval (Michler, Rep. U. S. & Mex. Boundary Survey, i, 101; Pac. R. R. Rep., iii, 50). DuPratz says that the Indian women not only "make the pottery but they dig up and mix the clay" (Hist. of Louisiana, Lond., 1774, 360).

Adair informs us that the Cherokees glaze their ware, and make it very black and firm by placing it in the smoke of a pitch pine fire (Hist. of Am. Indians, Lond. 1775, 4).

Hariot says of the natives of Virginia: "Their women know how to make earthen vessels with special cunninge, and that so large and fine that our potters with thoye wheels can make noe better" (DeBry, A brief Report, &c., 1590; Campbell, Hist. of

Virginia, 28; *The True Travels, &c.*, of John Smith, p. 131; Strachey, *The Hist. of Trav. into Virginia Britannica*, p. 112). On the Georgia Indians see Bartram, *Travels*, Lond., 1792, 511; On the Iroquois, Schoolcraft, iii, 81, and *Notes on the Iroquois* in Squier & Davis, 223; On the Hurons, Parkman's "*Jesuits in America*," p. xxx.

An account of the pottery manufactured among the Indians west of the Mississippi river is quoted from Hunter's "*Manners and Customs of several Indian tribes west of the Mississippi*" in Prof. Rau's article on Indian pottery in the *Smithsonian Report*, 1866, p. 351.

Among the Mandans, women were, as elsewhere, the makers of earthenware (Catlin, *Manners and Customs*, Letter 16).

Among the Micmac Indians of Acadia, the birch-bark vessels in which cooking is performed, are made by the women, and we have already seen how she prepares, among the Esquimaux, the stone lamps and cooking vessels.

Jewett thinks that the Celtic funerary urns were formed "most probably, judging from the delicacy of the touch, and from the impress of the fingers which occasionally remain, by the females of the tribes" (*Grave Mounds and their contents*, 83-85).

At Ordezan, near Bagnière de Bigorre, pottery similar to that found in caves is still manufactured by women. Tylor speaks of a set of hand-made pottery found in use by an old woman in the Hebrides.

The Kaffir women not only cook, but they make the pots they use, the clay for the purpose being obtained from ant-hills. They also make baskets that will hold milk or beer (*Wood's Unciv. Races*, 77, 143; *Campbell, Travels in So. Africa*, 523).

Burton says, concerning the manufacture of earthenware in Eastern Africa, "The figuline, a grayish brown clay, is procured from river beds, or is dug up in the country; it is subjected to the preliminary operation of pounding, rubbing dry on a stone, pulverizing and purifying from stones and pebbles. It is then worked into a thick mass with water, and the potter fashions it with the hand, first shaping the mouth; he adds an inch to it when dry, hardens it in the sun, makes another addition, and thus proceeds until it is finished. Lines and other ornaments having been traced, the pots are baked in piles of seven or eight, by burning grass. Usually the color becomes lamp-black. In Usagara, how-

ever, the potters' clay burns red like the soil. A cunning workman will make in a day four of these pots, some of them containing several gallons, and their perfect regularity of form, and often their picturesqueness of shape, surprise the stranger. The best are made in Ujiji, Karagwah and Ugunda, those of Unyamwezi are inferior, and the clay of Zanzibar is of all the worst."

Schweinfurth states that "as in the case with the majority of the inhabitants of Africa, the manufacture of pottery is practiced by the women (*Zeitschrift für Ethn.*, 1873, i, 8).

"In Yoruba," says Bowen, "the women make earthen pots" (Central Africa, p. 308); and so, also, do those of Garo-a-Bautschi and Tesan, and the Guinea coast. We are, therefore, I think, justified in coming to the conclusion that the fictile art, in its infancy, is confined to the women is as true of Africa as of America.

In the East Indian Archipelago, the Papuan women make pottery (*Journ. of Ind. Arch.*, v, 313; *Norris' Ethnogr. Lib.*, i; *Earl's Papuans*, p. 73). While pottery is unknown in the greater number of the South Sea Islands, in Fiji it has reached a high state of development (*Williams and Calvert. Fiji*, N. Y., 1859, 53; *Wood, Unciv. R.*, Amer. Ed., 930). Women have the making of pottery entirely in their own hands, and the art, moreover, seems to be confined to the women of sailors and fishermen. It is also worth noting that the Fiji women are skilled in the manufacture of stamped bark cloth, making the patterns themselves (see also *Jenkin's U. S. Expl. Exp.*, 341, 347; *Lubbock, Preh. Times*, 443; *Pickering's Races of Men*, 163).

The facts I have given seem to show that among savage tribes generally, the fictile art is, at first, exclusively practiced by women, the reason being that, primarily and essentially, the fabrication of earthenware is a branch of culinary work, which last, everywhere falls to the lot of the gentler sex. Man, among savages, is the hunter, fisher and warrior, while the woman takes care of the house, and of the culture of the field. When, however, in the progress of the tribe in culture, the practice of the art of pottery comes to be a profession, and to interfere with household work, it passes naturally into the hands of man, and it will be found that in every case where men make earthenware the tribe has advanced considerably beyond the savage state.

But savage woman not only fabricates vessels of clay, she also

ornaments them, and if the fictile art has originated with her, and has grown up under her hands, it seems no less probable that the ornaments she uses should have originated with her, and the probability is increased by the fact that to her falls the work of spinning and weaving, of making and decorating personal ornaments and clothes, and of making baskets, mats, etc. She is everywhere the primitive decorative artist, and to-day it is the exception that man occupies himself with ornamental art, even in civilized countries. Woman covers with ornament everything her hand touches, and the lady in her boudoir industriously embroiders, on some article of mere luxury, the same series of frets and scroll borders that, on the Amazonas, the savage unclothed squaw as diligently and with as firm a hand, traces with a spine on the damp surface of the clay vessel she is fashioning. It is as if they both sang the same simple song. The ornaments in both cases are identical and not only of wholly independent origin, but it may be also of very different age. Those of the savage are the mere embryonic beginnings of art-life, while those of the boudoir, like the *Lingula* of to-day, are archaic forms, persistent through the ages, still flourishing unchanged among the varied wealth of derivatives by evolution from the ancient primary forms.

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SEEDS OF THE VIOLET AND OTHER PLANTS AS PROJECTILES.

BY MOSES N. ELROD, M.D.

THE capsules of the cleistogenous flowers of *Viola cucullata*, *V. canadensis* and *V. striata*, by a peculiar mechanical movement of the valves project their seeds from a few inches to four or five feet. As *V. cucullata* is a very common plant, with numerous seed pods in the latter part of the season, it has been most carefully studied, and will be the first described. When the seeds are ripe, the pod that before had been folded back on its crooked procumbent stem, becomes erect, opens into three valves that place themselves at right angles with the straightened and erected peduncle, and, as it were, look directly upwards. By straightening the peduncle, the seed vessels that heretofore had been concealed, are brought on a level with or above the leaves. Each one of the carinate valves contains from three to four rows of